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ABSTRACT

This module: (1) discusses the need for disposing of waste safely; (2) provides information and activities on wet and dry wastes; and (3) shows how to prepare, maintain, and study a fertilizer basket (in which fertilizer is made from wet waste). Information on the biology of the basket (including role of bacteria and fungi in the decay process) is included. The module concludes with a two-part test (with answers). (JN)

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What We Make

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Science and Technology Education in Philippine Society

Goodbye, Waste!

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GOODBYE, WASTE!

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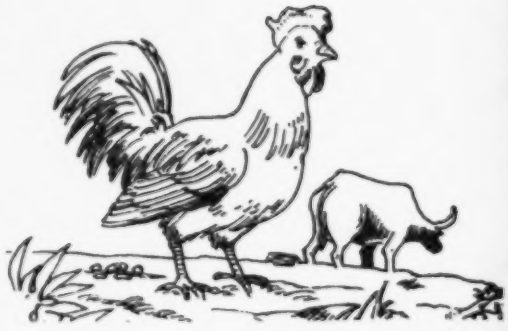
Goodbye, Waste!

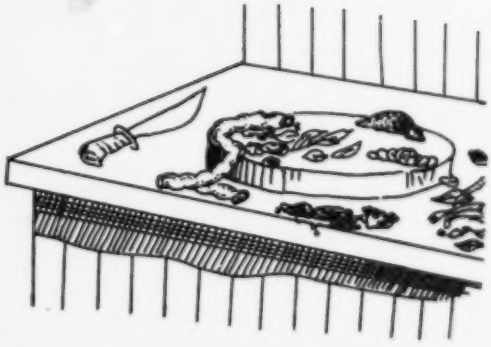
Waste, Waste

Everyday, we collect much waste . . . . . .

. . . . . from plants



. . . . . from animals



. . . . . from the kitchen

. . . . . from other activities

How do we get rid of waste?

We can dump the waste in a garbage heap.

But the garbage heap attracts flies, cockroaches and rats. These animals feed on garbage. They multiply fast and may cause diseases.

The garbage heap also gives off a bad smell. Besides, the garbage heap is ugly to see. So, dumping waste is not good.

Some people throw waste into a stream, a river, or a lake.

But throwing waste in a body of water makes it dirty. The stream, river or lake becomes polluted. Fish and other water animals that people eat cannot live in badly polluted waters.

We can bury the waste.

But this method needs much space. If our backyard is not big, and we keep on burying waste, we will run out of space.

Can we burn the waste? Yes, we can. We can burn leaves, pieces of paper, branches of trees, and other materials that easily burn.

But this method causes the air to become dirty or *polluted*. Polluted air can cause lung diseases, even cancer!

Besides, what do we do with cans, bottles and other materials that do not burn?

So, we have to use a better method to get rid of waste. This module suggests one way. At the same time, this method will make the waste useful again. Unbelievable? Maybe. But it is true. Find out for yourself by reading the following pages.

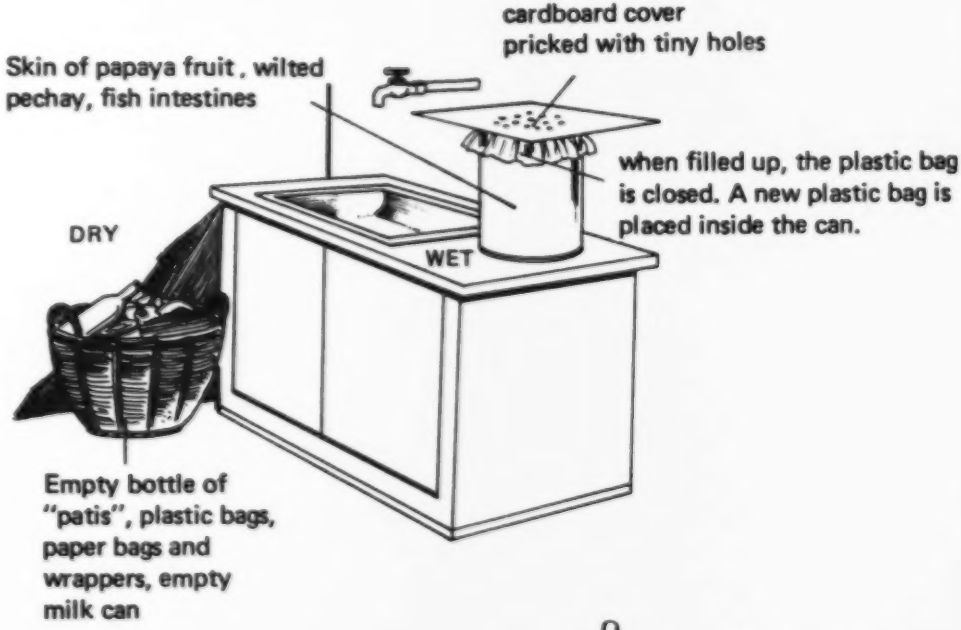
A Visit to the Bayani Home

The Bayani family has a modest home in barangay Malamig.

The area around their home is clean. No garbage heap attracts flies and other insects. No garbage floats in the nearby stream. How does the family get rid of waste?

First, the family separates wet waste from dry waste.

In the kitchen, there are two containers. One container holds a plastic bag for wet waste materials. The other container is for dry waste materials.


cardboard cover
pricked with tiny holes
Skin of papaya fruit, wilted pechay, fish intestines
when filled up, the plastic bag is closed. A new plastic bag is placed inside the can.
DRY
WET
Empty bottle of "patis", plastic bags, paper bags and wrappers, empty milk can

Notice that wet waste comes from food. Wet waste comes from parts of plants and animals.

In the yard, the Bayani family also separates the waste into wet and dry. Look at the pictures below. They show some activities of the family.

1. Name the kinds of waste shown in the picture.
2. Separate these into wet and dry waste.

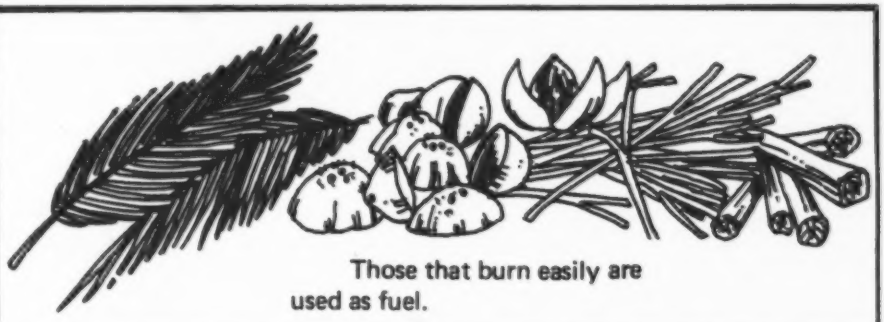
The Bayani family separates the wet and dry wastes further. The family separates the wastes into the 5 F's.

Some kitchen wastes are used as feeds for animals.

WET WASTE

FEEDS

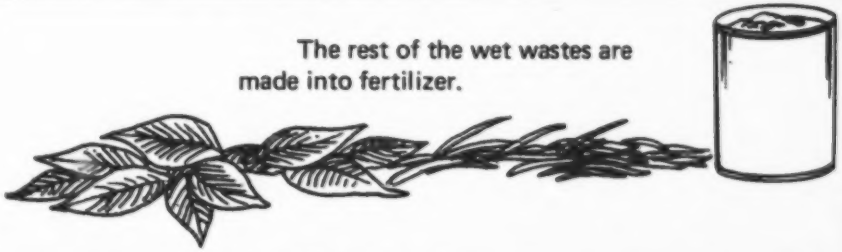
FUEL



Those that burn easily are used as fuel.

FERTILIZER

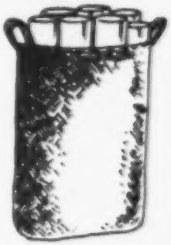
The rest of the wet wastes are made into fertilizer.



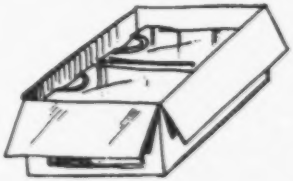
DRY WASTE

FACTORY MATERIALS AND FUTURE USE MATERIALS

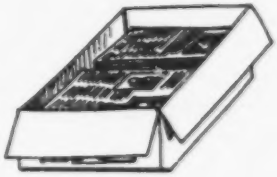
bottles and plastic containers



cans



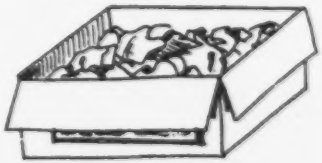
paper bags and plastic bags



newspaper

Most of the bottles, newspaper, paper bags, and cans are sold to "diyaryo-bote" buyers. Some are kept for future use of the family as containers and wrappers.

FUEL



Old or torn newspaper and paper bags, small pieces of paper, are used as fuel.

Look for this mark ——. It means you have to write the answer to the question.

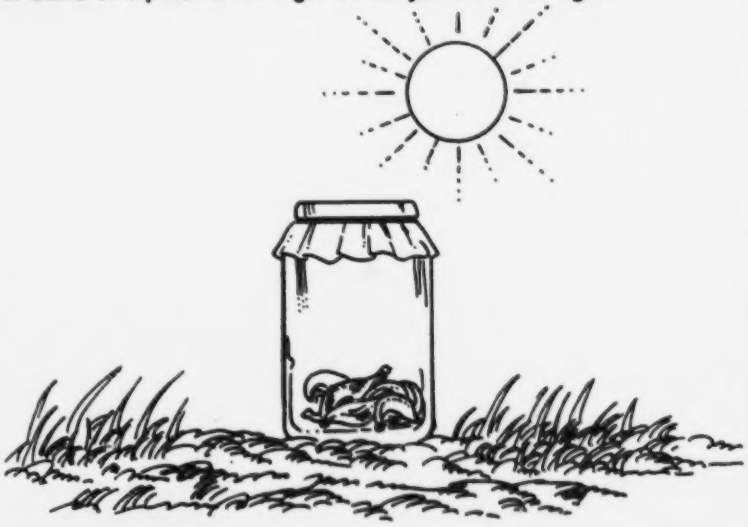
Remember the 5 F's in classifying garbage. The 5 F's are factory materials, future use materials, fuel, fertilizer, and feeds. They show how waste can be used again.

Some waste cannot be classified under the 5 F's. Examples are rusted cans, torn plastic bags, and broken plastic containers. These are given to the garbage collector. If no garbage collector comes, these are placed in a hole in the ground and covered.

Why is waste from plants and animals called wet waste? If you want to know the answer do Activity 1.

Activity 1

Put wet waste such as banana peeling in a glass jar. Cover the jar opening with a plastic sheet. Fix the plastic sheet in place. Use either a rubber band or a piece of string. Put the jar under sunlight.



After 5 to 10 minutes . . . . . .
look at the inner side of the plastic cover.

3. What do you see on this side of the plastic cover?
4. Where did they come from?

Plants and animals are mostly made of water. More than 70% of the weight of plants and animals is water.

This is why waste from plants and animals are classified as wet waste.

You can try classifying waste in your school or home. Do Activity 2.

Activity 2

a. Have separate cans for wet waste and dry waste in your classroom and throughout the school grounds.
b. At the end of each day, separate the waste further into the 5 F's.

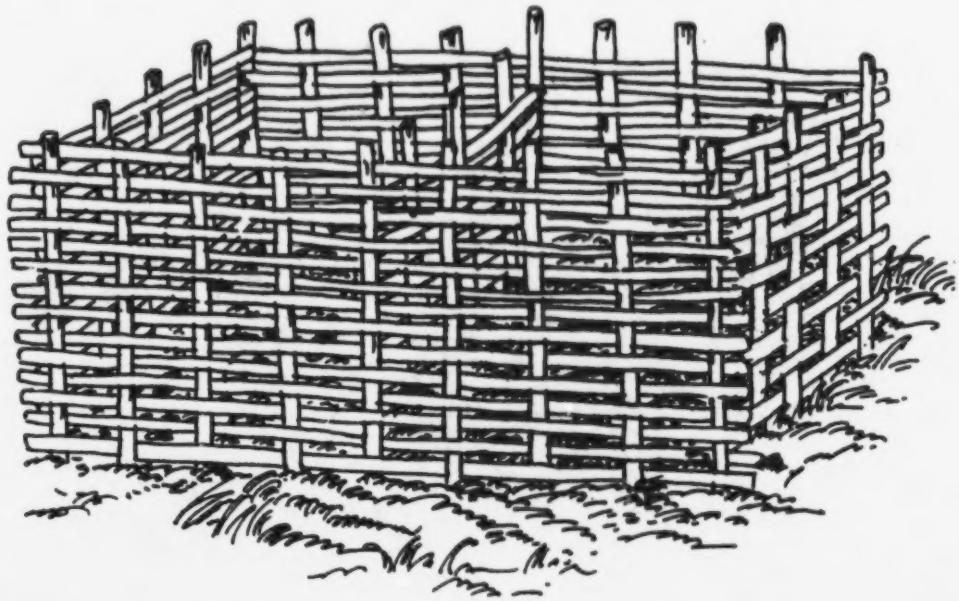
You can do this as a continuing activity in school. The teacher will assign groups to do step b.

The Fertilizer Basket

You have learned the 5 F's for classifying waste.

One of the F's stands for fertilizer. You will now see how the Bayani family makes fertilizer out of wet waste.

There are two bamboo containers in the Bayani backyard.



Mrs. Bayani calls each container a fertilizer basket. This is where the family dumps wet waste not used as feed or fuel.

At the end of each day, wet waste is added to the basket. In a few months, the waste will become fertilizer. Fertilizer is important for normal and healthy plants.

Mr. and Mrs. Bayani are very happy about this way of getting rid of wet waste.

I DO NOT HAVE TO BURN LEAVES. INSTEAD THESE ARE MADE INTO FERTILIZER. SEE HOW HEALTHY OUR VEGETABLES ARE?
NO BAD SMELL COMES FROM THE WASTE. NO FLIES AND COCKROACHES SWARM AROUND THE WASTE.

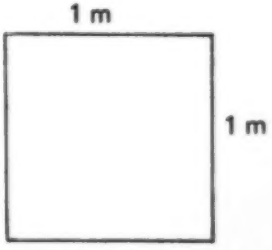
It is easy to make a fertilizer basket. If you want to make one in your school ground or backyard, do Activity 3.

Activity 3

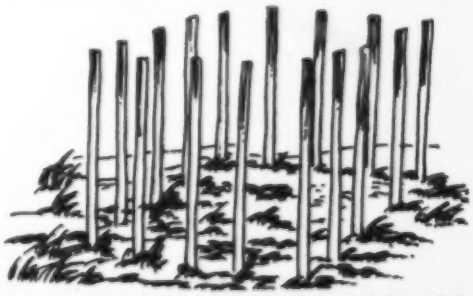
You will need:

16 bamboo sticks or any hard plant stem, each 1 m long
bamboo strips or pieces of vine or reed
any tool for digging the soil
meterstick or tape measure or ruler

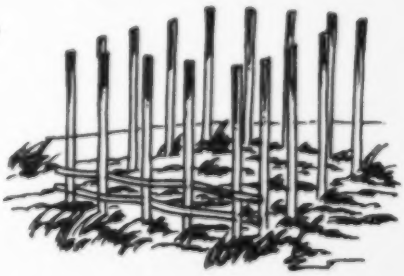
a. Mark a square area on the ground, 1 m on all sides.



b. Place the sticks firmly in the ground as shown.



c. Weave the bamboo strips through the upright sticks as shown.



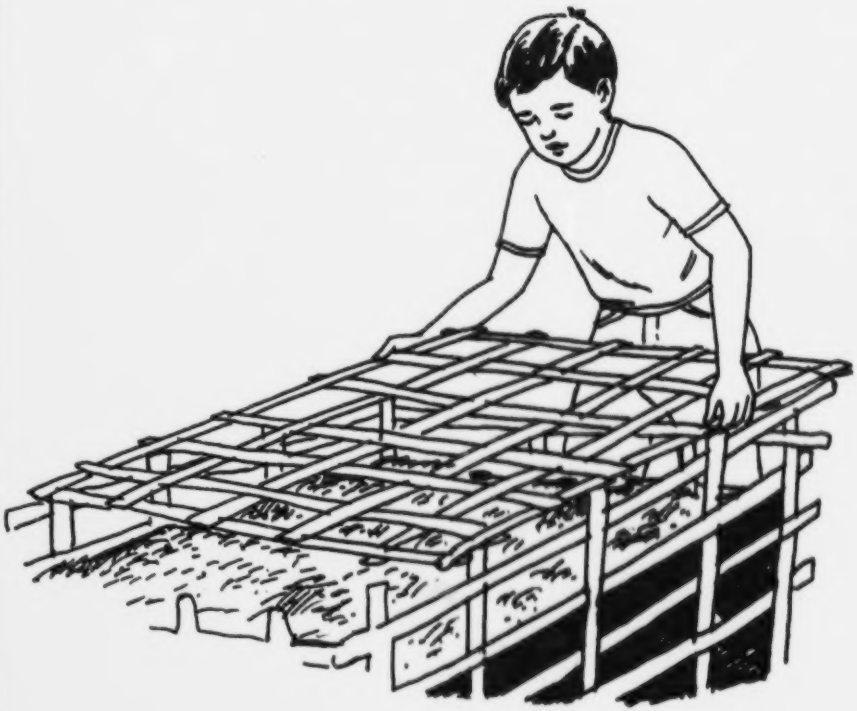
d. Collect wet waste. Dump this into the fertilizer basket.

5. Which of the following would you dump into the fertilizer basket?

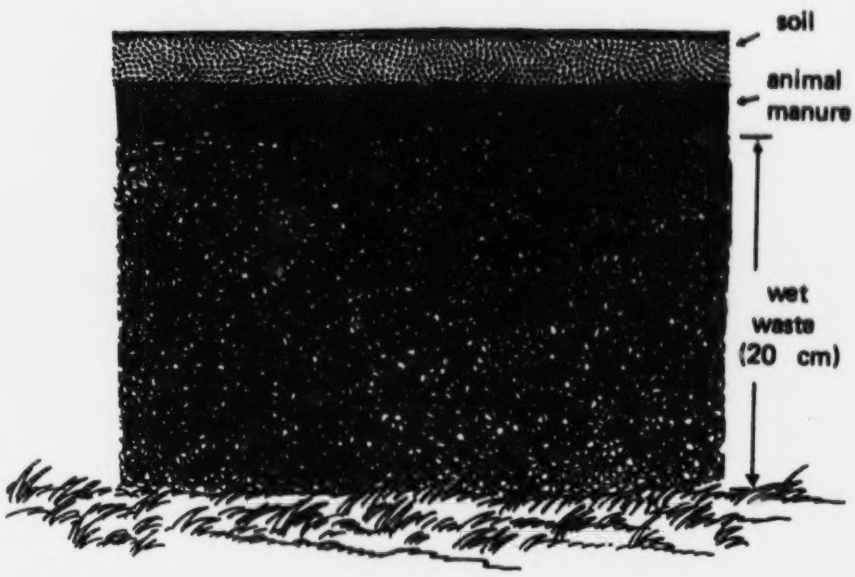
grass cuttings	a plastic bag
fallen leaves	moldy bread
a can	rotten fruit
leftover food	

e. Cover leftover food with leaves, grass cuttings or soil. Do this to stop flies from coming to the waste.

f. If you or your neighbors have chickens, cats, or other animals, cover the waste with woven bamboo sticks. This way, animals will not scatter the waste while looking for food.



g. Everyday, add wet waste to the basket. When the waste is about 20 cm high, add a layer of animal manure. Cover the animal manure with a thin layer of soil.



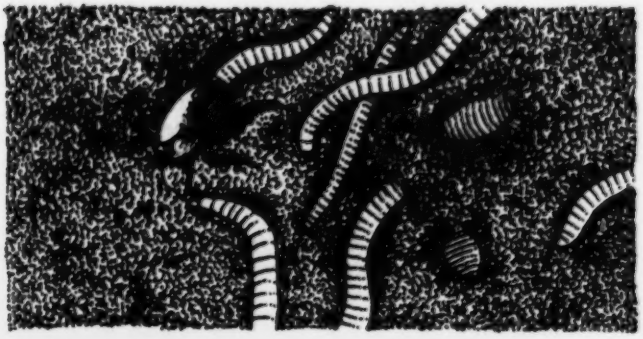
h. Repeat step g until the heap is 1 m high.

A Basketful of Life

You must be wondering what takes place in the fertilizer basket. What causes the wet waste to change into fertilizer? You can find the answer by reading this section.

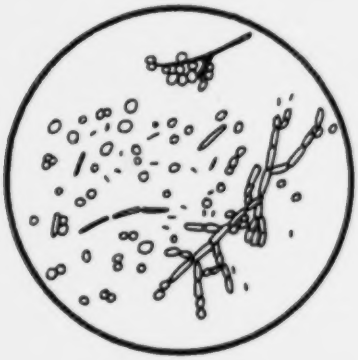
The fertilizer basket does not only have dead leaves, and other waste. It has many kinds of living things or *organisms*. These organisms are all very active. That is why we say the fertilizer basket is full of life.

Some organisms are big enough. You can see them with your eyes or with a hand lens.



These organisms feed on the waste. They *digest* the waste into simple materials. When *excreted*, these materials make the soil fertile.

Other organisms are tiny. They can be seen only under a microscope. These are the bacteria and some fungi.



Bacteria and fungi also feed on waste. To digest waste, bacteria and fungi cover the waste with something like our saliva. Through this way, the waste is changed into simple materials. These simple materials are returned to the soil. The action of bacteria and fungi on plant and animal waste is also known as *decay*.

Bacteria and Fungi Have Needs, Too!

Bacteria and fungi are living things. Like any living things, they need food.

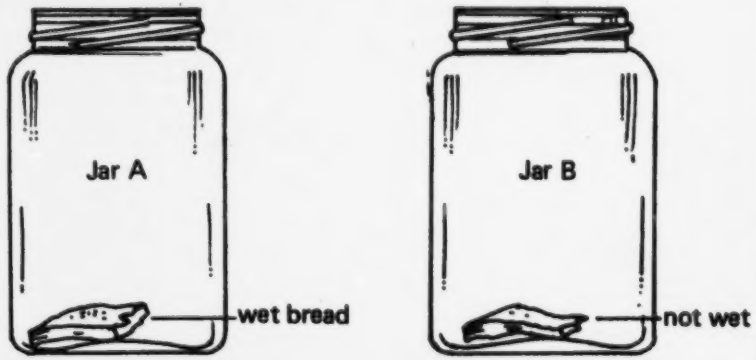
Do they also need water? You can do an experiment to find this out. See Activity 4.

Activity 4

You will need:

2 pieces of bread
2 glass jars
water

a. Sprinkle water on a piece of bread. Put this wet bread in the glass jar. Label this Jar A.
b. Do not wet the other piece of bread. Put it in the other jar. Label this Jar B.



c. Everyday, sprinkle water on the bread inside Jar A.
d. Observe the bread in Jar A and Jar B after three or four days.

You will see molds growing on the bread.

6. What do the molds look like?
7. Compare the growth of molds in Jars A and B.
8. Where do molds grow better, on wet bread or on dry bread?

Molds are a kind of fungi. They cause decay of bread and other foods.

Fungi need water. Like fungi and other living things, bacteria also need water.

Aside from food and water, bacteria and fungi need two other things. One is air. Many bacteria and fungi are more active when there is air.

The other thing is temperature. It must not be too high like the temperature of boiling water. It must not be too low, like the temperature of ice. Very high or very low temperature stops many bacteria and fungi from being active.

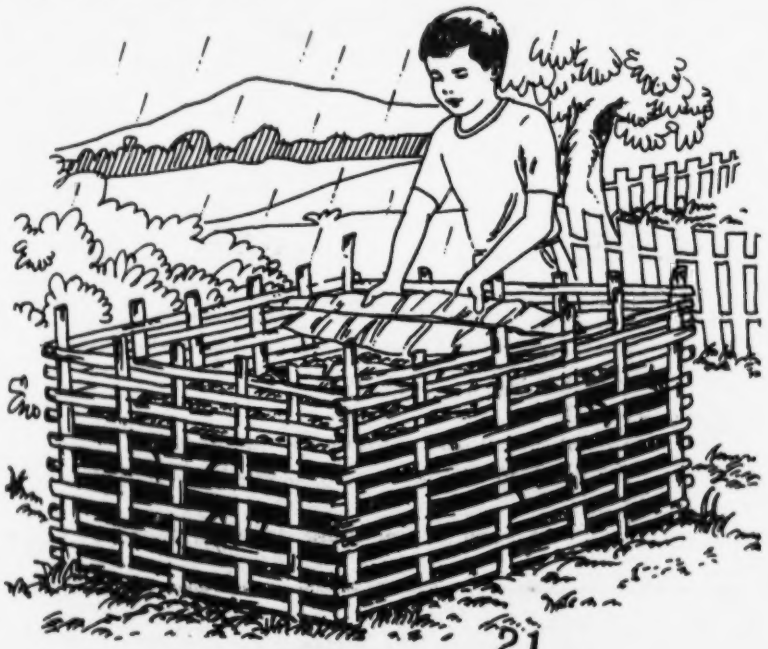
Now that you know the needs of bacteria and fungi, you understand why you have to take care of the fertilizer basket. See Activity 5.

Activity 5

In dry weather, water the waste to keep it moist.

9. Why is it important to keep the waste moist?

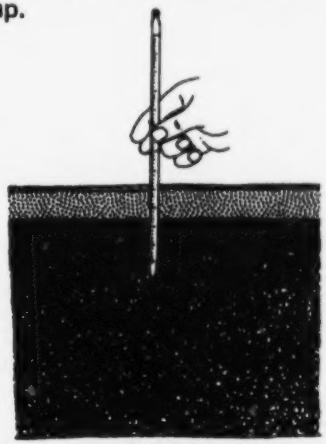
When it rains hard, cover the basket with banana or palm leaves, or a plastic sheet. If there is too much water, bacteria and fungi can not have the air they need.



Carefully loosen the heap of waste every other day. Use a piece of stick.

10. What enters the heap when it is loosened?
11. Why is it important to loosen the heap?

If you have a thermometer, measure the temperature inside the heap. If you do not have a thermometer, push your fingers into the heap.



12. What is the temperature of the heap?
13. Is it higher or lower than the temperature of air?
14. What is given off as shown by the temperature of the heap?

When the inside of the heap gets hot, decay is taking place.

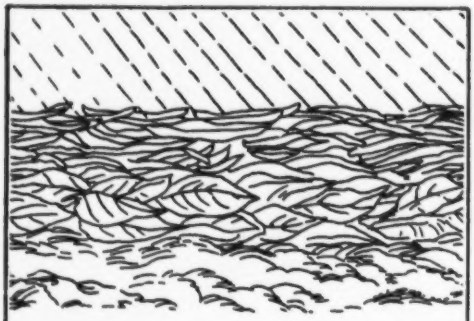
After four to six months, the waste at the bottom of the heap is changed into fertilizer.

Make another basket. Do steps a to c, Activity 3.

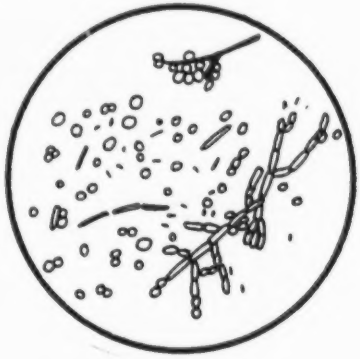
Transfer the upper half of the heap to the empty basket. Add wet waste to this heap everyday. Follow steps f and g, Activity 3. Now, you have a new fertilizer basket.

The Story of Decay

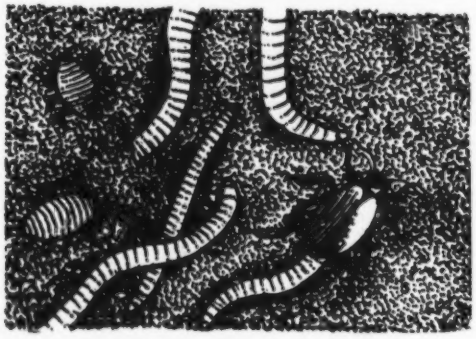
This is the complete picture of decay in the fertilizer basket.



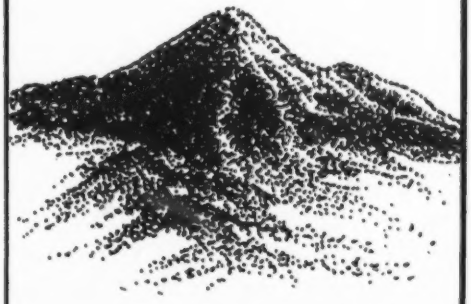
It all begins with plant and animal wastes. These are kept wet. Air must be able to enter the heap. Food, water, air, and proper temperature are needed by bacteria and fungi.



Bacteria and fungi feed on the wastes. These organisms give off something that changes the wastes to simple materials.

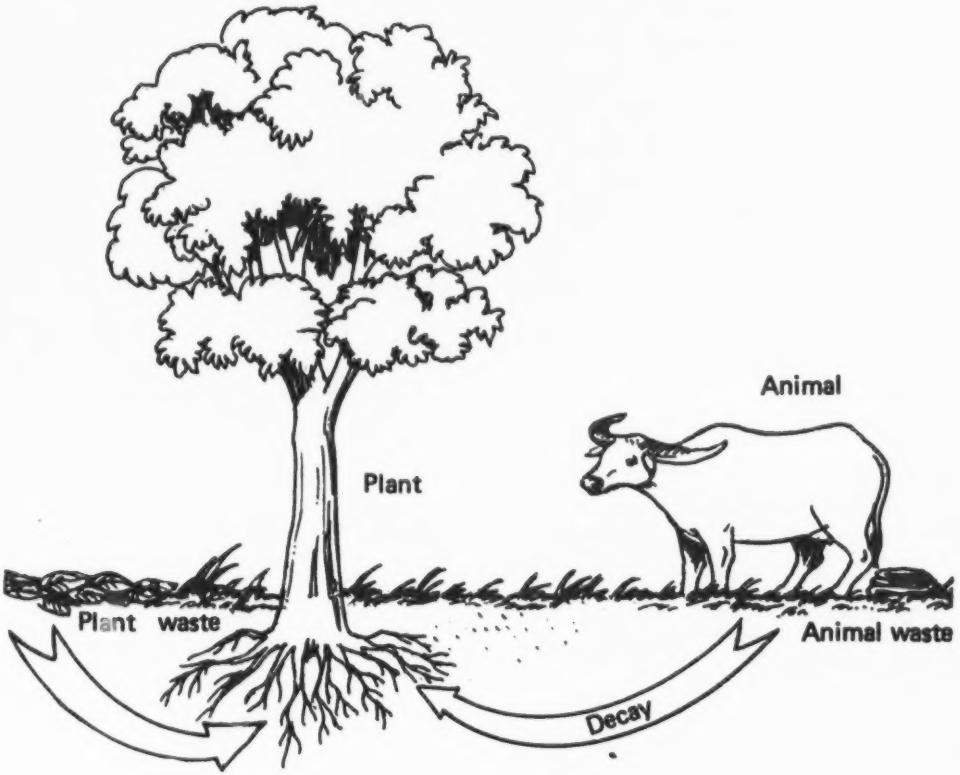


Insects, worms, and other animals bigger than bacteria and fungi also eat some of the wastes. They digest the wastes into simple materials. They loosen the heap, letting air enter.



After about six months, this is the end product – fertilizer for plants.

Decay takes place in nature, too.



Plant and animal wastes decay. Dead plants and animals also decay. These are changed into simple materials which are returned to the soil.

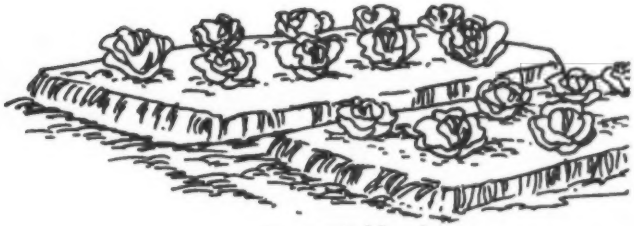
A growing plant takes in the simple materials it needs from the soil.

The plant keeps on growing. During its lifetime, the plant sheds leaves, flowers, and fruits. Then, the plant dies.

Or the plant can be eaten by an animal. The animal produces waste. After some time, the animal dies.

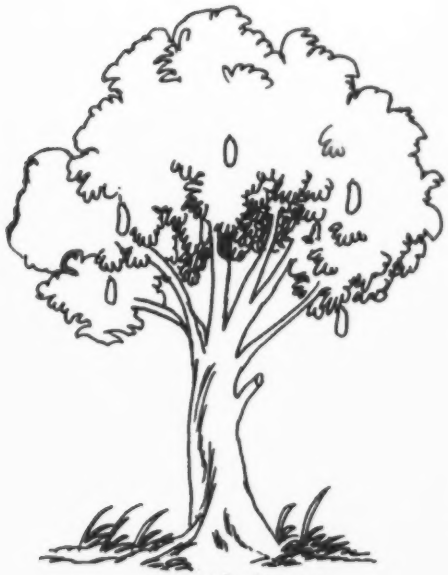
Decay again follows, and the story is repeated. Through decay, simple materials are used over and over again.

What can you do with your fertilizer? You can add it. . .



. . . to vegetable plots

. . . to flower gardens



. . . around fruit trees

. . . around potted plants.

Plants take in and use the fertilizer. Plants produce waste. Some plants die. Plant waste and dead plants are returned to the fertilizer basket. They decay.

You know the rest of the story. Like decay in nature, the story will be repeated, again and again.

Test Yourself

Part A

Questions 1 to 5 are about the situation below.

Suppose you collected the following wastes in your home.

a. grass cuttings
b. rusted can
c. bottles
d. wilted kangkong leaves
e. fallen leaves in the yard
f. rotten papaya fruit
g. old newspaper
h. plastic bag
i. animal manure
j. intestines and internal organs of fish and chicken
k. grated coconut meat after getting the milk
l. branch of guava tree
m. heads of fried fish
n. heads and feet of boiled chicken

1. Separate the waste into dry waste and wet waste. Use letters only.
2. Wet waste comes from _____.
   a. plants only
   b. animals only
   c. plants and animals
   d. plants, animals, and bodies of water
3. Classify the dry waste and wet waste into the 5 F's. Use letters only.

Dry waste

Factory Materials	Future Use	Fuel
_____	_____	_____
_____	_____	_____
_____	_____	_____

Wet waste

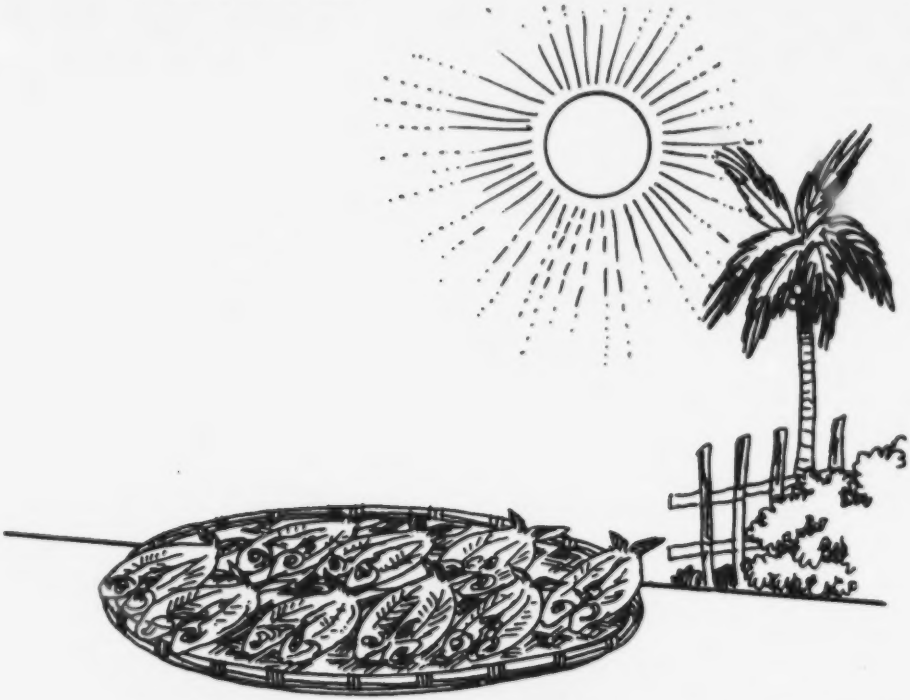
Fuel	Feeds	Fertilizer
_____	_____	_____
_____	_____	_____
_____	_____	_____

4. Fatima's family has a dog and a few chickens. The family uses the following wastes as feeds.

   grated coconut meat after getting the milk
   heads of fried fish
   heads and feet of chicken

   Will you also use these wastes as feeds? If yes, why? If no, why not? How will you use the wastes?
5. In the list of waste materials a to n, which will you bury in the ground or give to the garbage collector? Why?

Questions 6 and 7 are about the situation below. Aling Carmen prepared dried fish.



6. Before drying, the fish weighed 1,000 grams (1 kilogram). After drying, the fish weighed 400 grams. This shows that_____.
   a. fresh fish has a large amount of water.
   b. fresh fish has a small amount of water.
   c. fresh fish has more protein than dried fish.
   d. fresh fish has more calcium and vitamin D than dried fish.

7. Fresh fish decays after a day. Aling Carmen's dried fish did not decay for two weeks. This is because bacteria and fungi that cause decay need
   a. air.
   b. water.
   c. soil.
   d. sunlight.

Questions 8, 9, and 10 are about the fertilizer basket in Totoy's yard.

8. Totoy has to take care of the fertilizer basket. Which of the following should Totoy do?
   a. Water the waste on dry days.
   b. Step on the waste to pack it tightly.
   c. Dry the waste by putting it in sunlight.
   d. Cover the waste during a heavy rain.
   e. Remove decaying animal parts.
   f. Loosen the waste gently with a stick.
9. Explain why Totoy should do each activity you chose in 8.
10. Which of the following things will happen in the fertilizer basket within four months?
    a. The temperature will go up.
    b. Bacteria and fungi will feed on the waste.
    c. The waste will become finer.
    d. The waste will become fertilizer.
    e. Small animals like insects and worms will feed on the waste.
    f. The waste will give off a bad smell.

Part B

1. Do you separate wet waste from dry waste in your home?
   - ☐ Yes, sometimes
   - ☐ Yes, always
   - ☐ No
2. Do you separate wet waste from dry waste in school?
   - ☐ Yes, sometimes
   - ☐ Yes, always
   - ☐ No
3. Do you reuse wet waste and dry waste?
   - ☐ Yes, sometimes
   - ☐ Yes, always
   - ☐ No

4. Did you make a fertilizer basket at home?
   - ☐ Yes
   - ☐ No
5. Do you put wet waste into your fertilizer basket at home?
   - ☐ Yes, sometimes
   - ☐ Yes, always
   - ☐ No
6. Do you put wet waste into your fertilizer basket in school?
   - ☐ Yes, sometimes
   - ☐ Yes, always
   - ☐ No
7. Do you take care of your fertilizer basket?
   - ☐ Yes
   - ☐ No
8. Have you told your family and friends about the benefits of reusing waste?
   - ☐ Yes
   - ☐ No

References:

1. Johnson, Cecil E. "The Wild World of Compost." *National Geographic*. Vol. 158(2) 1980, pp. 273-284.
2. Sabas, Luz Escalante. "The Four-F Scheme for Recycling Domestic Waste." Unpublished M.A.T. Seminar Paper, U.P., 1979, 159 pp.
3. Technical Working Group Meeting on Science in Basic Functional Education: Links with Real-Life Situations. Manila, 1976. "Goodbye Waste." UNESCO Regional Office for Education in Asia and Oceania, Bangkok, 1979.

Answer Key to questions marked

1. Grass cuttings, fallen leaves, branch, pieces of paper, plastic bags, coconut husk, coconut shell, carabao manure
2. Wet waste: grass, fallen leaves, branch, coconut husk, coconut shell, carabao manure
   Dry waste: pieces of paper, plastic bags
3. Water droplets
4. From the waste

5. Grass cuttings, fallen leaves, leftover food, moldy bread, rotten fruit
   (Note: Instead of putting leftover food in the fertilizer basket, you may use it as feeds. This answer is acceptable.)
6. Molds look like fine, hairy structures.
   (Note: The molds may vary in color; they may be yellow, green, or gray. Others may have spores. If there are microscopes in your school, you may examine molds under the microscope. Ask your teacher to help you.)
7. There are more molds in jar A.
8. On wet bread.
9. Bacteria and fungi need water.
10. Air
11. Many bacteria and fungi are more active in the presence of air.
12. Note: You may observe a temperature of about 38°C up to 45°C for about one week. This is from day 4 to day 11 after covering the waste with carabao manure and soil.
13. Higher
14. Heat

Answer Key to Test Yourself

Part A

1. Dry waste: b, c, g, h
   Wet waste: a, d, e, f, i, j, k, l, m, n
2. c
3. Dry waste

Factory materials	Future Use	Fuel
c	h	
g		

Note: Answers may vary. Bottles (c) and old newspaper (g) may also appear under future use. Old newspaper (g) may be classified under fuel.

Wet Waste

Fuel	Feeds	Fertilizer
l	k	a
	m	d
	n	e
		f
		i
		j

Note: Again, answers may vary according to the needs of the family. Kangkong (d) and rotten papaya fruit (f) may be listed under feeds depending on the kind of animals raised. If, on the other hand, your family does not raise animals, not even pets, there will be no answer under feeds.

4. Note: Answers will vary according to the needs of your family.
5. Rusted can, because it cannot be reused.
6. a
7. b
8. a, d, f
9. a – Bacteria and fungi need water.
   d – During a heavy rain, the spaces between the waste materials will be filled with water. There will not be enough air left for bacteria and fungi.
   f – To have more air spaces between the waste materials. Many kinds of bacteria and fungi need air.
10. a, b, c, d, e

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